ASSESSING FISCAL SUSTAINABILITY: A REVIEW OF METHODS WITH A VIEW TO EMU

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1 Introduction

While the intuition is clear (a sustainable policy must ultimately avoid bankruptcy), the analytical and operational definition of sustainability is not straightforward. The theory has proposed different conditions for sustainability (from a non ever-rising tax rate to an inter-temporal discounted budget constraint[1]); furthermore, the problem has always been dealt with in a partial equilibrium framework where the interactions between the budget and the economy are not fully taken into account. In practice difficulties arise with regards to the statistical definition of the main variables to be used for the assessment of sustainability (is it gross or net debt to be relevant, how should the deficit be measured?); moreover, as sustainability is a forward looking concept, long term projections are needed and these are necessarily subject to wide margins of error.

Yet sustainability is a central tenet of the Maastricht Treaty. Article 109j(1) makes a sound government financial position an explicit criterion for a country's eligibility to EMU. The fiscal rules set in the Treaty and subsequently integrated by the Stability and Growth Pact require budget positions close to balance or in surplus in the medium

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1 See, respectively, Domar (1944) and Blanchard *et al.* (1990).

term, deficits lower than 3 per cent of GDP and the reduction of debt to GDP ratios below 60 per cent. Compliance with these rules, which aims at combining fiscal discipline and flexibility, clearly excludes divergent and unsustainable fiscal dynamics[2].

Although the choice of the actual parameters is somewhat arbitrary[3], the pragmatic approach taken by the Treaty and the SGP is justified by the difficulty to firmly base on theoretical grounds any benchmark against which to assess sustainability. EMU rules can be said to provide applied economists with the benchmark the theory has not produced. In a sense, EMU rules have also reduced uncertainty concerning the statistical definition of the main variables to be used for the assessment of sustainability: European legislation refers to statistical protocols for the definition of "debt" and "deficit".

Prospective compliance with EMU rules can thus be assessed using techniques developed for the analysis of sustainability on the basis of data whose definition is no longer subject to debate. As the accuracy of such prospective assessments is crucial both for policy evaluation and for the feasibility of timely corrective intervention, it seems a worthwhile exercise to re-examine the pros and cons of different assessment methods proposed in the literature: while EMU's rules provide a reference for the definition of sustainability and of the variables relevant to its assessment, the problems related to the partial equilibrium nature of the analysis and to the use of long-term projections are left for the economists to tackle.

The need for accurate indicators is presently made impelling by such issues as the unfavourable demographic trends facing most EU countries, the sensitivity to macroeconomic shocks of the large stocks of government liabilities still outstanding in some countries, the risk that the process of economic integration may trigger tax competition and degradation.

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[2] The policy stance implied by these parameters may often be tighter than what is needed for sustainability by any definition adopted; see e.g. Pasinetti (1997), Kikkunen and Kuoppamaki (1998), Balassone and Monacelli (2000).

[3] The economic rationale of the parameters has indeed been questioned, see e.g. Buiter et al. (1993) and Eichengreen and Von Hagen (1996) for a discussion.

The purpose of this paper is to review the literature on fiscal sustainability in order to examine the comparative advantages and disadvantages of different methodologies and indicators and to highlight the areas in which more effort is needed. The next section focuses on the theoretical definition of sustainability, while section 3 is concerned with statistical issues. Sections 4 to 7 review the literature on assessment methods grouping studies into two main strands: (a) those testing for the sustainability of past policies (section 4); (b) those assessing prospective fiscal stances. Among the latter a distinction is drawn between works based on standard national accounting concepts (section 5) and generational accounting exercises (section 6). Section 7 summarises the main findings and concludes.

2 Defining sustainability

For a long time the issue of sustainability has been addressed only in terms of the effects of public debt on the economy. According to Hume, public debt was likely to lead to injurious tax increases in the short term and possibly to default in the long term. Smith also considered that debt financing would lead to default. The consensus view was that debt financing was to be used only under exceptional circumstances, such as wars[4].

Initially the analysis focused on the comparison between tax and deficit finance of public expenditure. The main issues concerning the hypothesis of debt neutrality (i.e. the equivalence of deficit and tax finance with respect to capital accumulation) and the intergenerational distribution of its burden were tackled by Ricardo[5]. Against debt neutrality he argued that, due to fiscal illusion (i.e. the inability of agents to correctly anticipate future taxes needed to finance the debt), debt induces a smaller reduction of consumption than taxes do; hence the former exerts a comparatively negative effect on capital accumulation. According to Ricardo the cost of debt is borne when resources are used

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4 See Shaviro (1997) for a summary of the early debate.

5 See Sraffa (1951) vol. IV, p.187-8 and vol. I, p. 247. See also Shoup (1960). Also Smith discussed fiscal illusion and the merit of expenditures to be deficit-financed.

and therefore falls onto current generations. In his writings, there is only one channel through which future generations may be burdened by the debt, that is the negative effects of debt finance on capital stock.

Between the end of the 19th and the beginning of the 20th century, the "Italian school" of public finance explored further the conditions needed for debt neutrality to hold: Pantaleoni and Borgatta focused on the role of bequests; De Viti De Marco on financial markets imperfections; Griziotti on agents' time horizons; Puviani on bounded rationality and fiscal illusion[6]. The neutrality hypothesis came to the fore again much later with Barro's (1974) contribution who put it into a fully formalised framework and highlighted the relevance of intergenerational altruism as an alternative hypothesis to the one concerning infinite time horizons.

The issue of the generational distribution of the burden of the debt was also debated for a long time. The position originally held by Ricardo, that the cost of debt is borne when resources are used, was taken up in the 1940s by the so called 'real resources view'. According to the supporters of this view the burden of the debt is borne by current generations as they pay the opportunity cost of financing it. The future servicing and repayment of the debt will only entail transfers from the general tax-payers to the bond-holders, and as long as the debt is internally held this does not alter the overall volume of resources available (the "we owe the debt to ourselves" argument; see, e.g. Lerner, 1943, and Chase, 1943).

Supporters of the 'real resource view' generally recognised the relevance of the effects of debt finance on the rate of capital accumulation, and agreed that if these effects are negative than future generations may be said to be burdened by the debt in the sense that they receive a lower capital stock. On the other hand, they pointed out that this does not necessarily imply a reduced degree of Pareto efficiency. Moreover, they highlighted the need to consider the use to which resources are put by the public sector: if public expenditure translate into

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6 See, for example, Griziotti (1917), De Viti de Marco (1934) and Puviani (1903).

capital accumulation then the rates of return to private and public use of available resources need to be compared[7].

The 'real resource view' developed in the context of the gradual diffusion of the keynesian theory, according to which markets are generally unable to ensure full employment of available resources. Debt finance is therefore necessary to provide the proper level of aggregate demand "...when private investment is insufficient to absorb intended savings over a relatively long period of time." (Domar, 1944, p. 147)[8].

The legitimacy of debt-finance for public investment ("golden rule") was increasingly recognised. During the 1930s, the introduction of the dual budget was proposed and hotly debated[9]. Sweden, for example, introduced the dual budget in 1937. The separation of current and capital operations was considered attractive since it spreads the costs of durables over the years during which they will be used and emphasises the effects of each budgetary operation on the net worth of the public sector. In the same vein, art. 115 of the German Constitution allows yearly deficits up to the level of gross investment in the federal budget[10].

Debt finance met still opposition with respect to the dead-weight loss due to the larger taxes needed later to service and repay the debt. Contrary to this view, it was pointed out that "… public debt need not be repaid …[as]... the debt is refunded ..." (Musgrave and Musgrave,

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7 The so-called 'utility view' elaborated a different argument by shifting the focus of the analysis from social to individual costs. According to this view, the burden of the debt falls onto future generations independently of the effects of debt on capital accumulation. Bond-holders have voluntarily given up resources now to have them back in the future so that their utility is not reduced; future tax-payers, on the other hand, will be forced to transfer (via the tax bill) resources to the bond-holders so that their utility will be reduced (see e.g. Buchanan, 1958). It may be argued that there is no contrast between the 'real resource view' and the 'utility view' as they attach different meanings to the same label (see Scitovsky, 1961, and West, 1975).

8 The theory of functional finance also develops in these years. Lerner (1943) argues in favour of debt-financing to boost aggregate demand during recessions and suggests to compensate those deficits by corresponding budget surpluses during expansions.

9 See Premchand (1983). Poterba (1995) points out that in the USA proposals to exclude capital outlays from the operating budget and to include depreciation of government capital stock date back at least to Musgrave (1939).

10 The debate on the golden rule is still ongoing. See, e.g., Balassone and Franco (2000).

1984, p. 688-689)[11] and that "the phrase 'burden of the debt', if it has any meaning, evidently refers to the tax rate (or rates) which must be imposed to finance the service charges, and that the *tax rate* will rise is far from evident" (Domar, 1944, p. 798).

At this stage the issue of debt sustainability was essentially specified in its main respects. The question was: are there limits to debt accumulation in the sense that its effects on accumulation and growth may determine an unbearable burden (as measured by the implied tax rate)? The answer requires the specification of the equation governing the dynamics of the debt to GDP ratio as a function of budgetary policy (tax, interest and primary expenditure ratios) and of its effects on macro parameters as the rate of interest and the rate of growth. Unfortunately there was not (and there isn't still) an agreed upon theory of the interactions between the public budget and the economy.

The only choice was (and still is) to use a partial equilibrium framework, assuming that both the interest rate and the growth rate are exogenous to fiscal policy. The partial equilibrium nature of the exercise implies that the possible effects of growing debt on interest rates and growth are overlooked[12]. The analysis is driven back to the crucial issue of the traditional debate on the burden of the debt: its effects on accumulation and growth.

This framework was first used by Domar (1944) to answer concerns that "… continuous government borrowing results in an ever rising public debt, the servicing of which will require higher and higher taxes; and that the latter will eventually destroy our economy or result in outright repudiation of the debt" (p. 148). Domar showed that a constant overall deficit to GDP ratio ensures convergence of both the debt to GDP ratio and the interest to GDP ratio to finite values. Consequently also

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[11] There is of course the risk that when the size of roll-overs grows, public finances become exposed to financial markets turbulence.

[12] The limits of the approach were of course clearly perceived: "… the issue rather is how interest service will affect the economy …" (Musgrave and Musgrave, 1984, p. 689); "… the problem of the debt burden is a problem of an expanding national income. How can a rapidly rising income be achieved?" (Domar, 1944, p. 166).

taxes needed to service interest payments converge to a finite value as a share of GDP.

Formally, let d be the debt to GDP ratio, b the deficit to GDP ratio, τ the tax to GDP ratio set equal to the ratio of interest payments to GDP, γ the rate of growth of GDP and ρ the rate of interest, then

$$d_t = [1/(1+\gamma)]\, d_{t-1} + b \tag{1}$$

$$d_t = d_0\,(1+\gamma)^{-t} + b \sum_{i=1}^{t} (1+\gamma)^{-(t-i)} \tag{2}$$

$$\lim_{t\to\infty} d_t = b\,(1+\gamma)/\gamma \tag{3}$$

$$\lim_{t\to\infty} \tau_t = \lim_{t\to\infty} \rho[d_{t-1}/(1+\gamma)] = b\,(\rho/\gamma) \tag{4}$$

The partial equilibrium nature of the model does not allow to define a sufficient condition for sustainability. Whether the levels to which the debt and tax ratios converge according to (3) and (4) can be sustained depends on their effects on ρ and γ. The assessment must be made outside the model. However, a necessary condition for sustainability can be defined: an ever-growing tax ratio cannot be sustainable. Equation (4) shows that this requires the debt to GDP ratio to converge to a finite value[13].

The debate on sustainability took a new twist in the eighties, in connection with the growth of the public sector and the unfavourable demographic trends. It was spurred by estimates pointing to substantial prospective increases in public expenditure[14]. The development of large welfare systems implied large scale implicit liabilities whose amount is related to the age structure of the population. The additional tax burden required to finance expected expenditure increases became the primary

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[13] The burden of debt can also be measured in terms of primary balances. In Domar's model, given a constant overall deficit, the primary balance will have to adjust to compensate for growing interest payments. The primary balance is defined as $p_t=b-\rho[d_{t-1}/(1+\gamma)]$ so that also convergence of p to a finite value requires convergence of d. Using equation (3) in the text, we see that p converges to a surplus: $\lim_{t\to\infty} p_t = b[(\gamma-\rho)/\gamma]$.

[14] International economic organisations largely contributed to developing long term projections. See, for example, OECD (1985) and the IMF study by Heller *et al.* (1986).

concern. The cost of implicit liabilities would in several countries dwarf that of the public debt. In evaluating public finance sustainability it was no longer sufficient to examine the tax rate implications of a constant deficit, à la Domar. It became necessary to estimate the future deficit path implied by current policies.

However, from a formal point of view, Domar's definition of sustainability was still acceptable. Buiter (1985) defined a sustainable policy as one capable of keeping the ratio of public sector net worth to output at its current level. Blanchard *et al.* (1990) proposed two necessary conditions for sustainability: (a) "… that the ratio of debt to GNP eventually converges back to its initial level …" (p. 11); (b) that "… the present discounted value of the ratio of primary deficits to GNP … is equal to the negative of the current level of debt to GNP …" (p. 12).

The second condition can be derived as follows. Let us rewrite eq. (1) splitting the deficit between the primary balance (p_t) and interest payments:

$$d_t = [(1+\rho)/(1+\gamma)]\, d_{t-1} + p_t \tag{5}$$

According to (5) the debt ratio at any time is given by

$$d_T = [(1+\rho)/(1+\gamma)]^T d_0 + \sum_{t=1}^{T} \{p_t [(1+\rho)/(1+\gamma)]^{(T-t)}\} \tag{6}$$

Discounting (6) to time zero we have

$$[(1+\rho)/(1+\gamma)]^{-T} d_T = d_0 + \sum_{t=1}^{T} \{p_t [(1+\rho)/(1+\gamma)]^{(-t)}\} \tag{7}$$

and taking the limit for $T \to \infty$

$$\lim_{T\to\infty} [(1+\rho)/(1+\gamma)]^{-T} d_T = d_0 + \lim_{T\to\infty} \sum_{t=1}^{T} \{p_t [(1+\rho)/(1+\gamma)]^{(-t)}\} \tag{8}$$

Finally, assuming that the discounted value of the debt ratio tends to zero, i.e.

$$\lim_{T\to\infty} [(1+\rho)/(1+\gamma)]^{-T} d_T = 0 \tag{9}$$

we have the required condition

$$\lim_{T\to\infty} \sum_{t=1}^{T} \{p_t [(1+\rho)/(1+\gamma)]^{(-t)}\} = -d_0 \qquad (10)$$

Blanchard *et al.* (1990) treat the two conditions as equivalent (pp. 11-12). However, as the authors acknowledge (p. 14), there is a difference: the necessary requirement for the second definition, i.e. the convergence to zero of the discounted value of the debt ratio (equation 9), is consistent with the undiscounted debt ratio converging to its initial value, converging to any other finite value, or diverging though at a rate lower than the difference between the interest rate and the rate of growth of GDP. So, while the first condition implies the second, the latter is necessary but insufficient for the first to apply.

With respect to the necessary condition for sustainability used in Domar's paper (convergence of the undiscounted debt ratio to a finite value), the first definition in Blanchard *et al.* is tighter; but it is so at a cost of arbitrariness. As we already noted Domar's model cannot specify the maximum sustainable debt level and Blanchard *et al.* do ackowledge that "… the justification for the ratio to eventually return to its initial level, as opposed say to zero, or to a higher but stable level, is, however, much less evident …" (p. 11)[15].

On the contrary, the second definition is looser than Domar's one: an ever-growing undiscounted debt ratio is allowed. As the authors explain, "… this is because of discounting, which implies that things far in the future do not matter much for today …" (p. 14). However, as pointed out by Artis and Marcellino (1998), "… this suggests that both quantities should be analysed and not only the discounted one …" (p. 6).

All three conditions have been employed in empirical studies on sustainability so that it is not always clear that different authors are talking about the same thing when they try to assess the "sustainability" of public finances. The absence of a clear-cut theoretical benchmark to assess sustainability has often favoured the use of ad-hoc definitions such

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[15] The definition of a precise benchmark is functional to the computation of the synthetic indicators of sustainability proposed by Blanchard *et al.* (1990). See section 5.

as that of Buiter (1985) and the first one proposed by Blanchard *et al*. (1990). The problem also became evident in the definition of EMU's fiscal rules.

The Treaty of Maastricht (Article 109j(1)) requires "the sustainability of the government financial position" for a country's eligibility to EMU. Article 104c(2) defines the criteria to evaluate sustainability by means of reference values for deficit and debt to GDP ratios. The annexed Protocol on excessive deficits specifies such values respectively as 3 and 60 per cent. A pragmatic approach to the issue was therefore taken. Sustainability is defined as non-violation of arbitrarily predefined parametric standards.

The Stability and Growth Pact has introduced the medium term target of a position close to balance or in surplus thus tightening the deficit rule while also trying to reconcile it with the possibility of countercyclical fiscal policy. In this context the issue arises of the actual definition of the "medium term position close to balance or in surplus" which allows compliance with the 3% ceiling during cyclical downturns (see e.g. Buti et al., 1997 and 1998, and OECD, 1998). The equilibrium value of the debt ratio will depend on the actual numerical realisation of the medium term close to balance or in surplus position.

The deficit ceiling is reminiscent of the constant deficit assumption analysed by Domar (1944). Apparently conscious of the partial equilibrium nature of Domar's results, the debt ceiling avoids convergence at high levels of debt[16]. For policy evaluation, we may see EMU fiscal rules as providing applied economists with that unique benchmark that the theory has not produced.

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[16] Compliance with EMU rules is clearly consistent with the second definition proposed by Blanchard *et al.* (1990): a debt ratio converging below a finite threshold implies a discounted debt ratio converging to zero.

3 Defining variables

General issues

The identification of the empirical counterparts to variables appearing in the equations of section 2 is also a relevant issue. It is closely related to the definition of sustainability adopted.

First of all, the sector of reference should be defined. In principle, the definition should include all the public bodies whose financial behaviour ultimately has an impact on central government accounts. In practice, there is a large grey area, which regards, in particular, public enterprises.

As to the debt, one has to choose between gross and net measures, face values and market prices, nominal and real values.

The definition of sustainability adopted is especially relevant to the choice between gross and net measures. The tax rate on which Domar (1944) focuses his analysis refers to the additional revenue needed to pay interest on debt with respect to a situation in which no debt is issued. In this case the appropriate measure of debt would appear to correspond to gross interest bearing liabilities. If reference is made to the inter-temporal discounted budget constraint, all liabilities should be considered. The debt measure could be either net or gross of assets as long as the deficit measure is defined accordingly (i.e. as resulting from non financial transactions only in the first case or as resulting from non financial transactions plus transactions in assets in the second).

As the assets owned by government can be sold to repay the debt, a net debt measure may perhaps constitute a clearer benchmark (although the issue of the degree of liquidity of government assets should also be taken into account). However, data on assets are often regarded as unreliable, especially those on non-interest bearing assets, so that on practical grounds one may opt for a gross measure of debt[17].

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[17] On problems related to the measurement of net worth and its changes see Blejer and Cheasty (1991).

The issue of valuation can be addressed from different points of view. For governments, market valuation is not the relevant measure. It refers to the sum the government would be asked to pay if it were to buy back its debt before it falls due, but the government has no obligation to do so. In evaluating its solvency, therefore, the relevant price is the one to be paid when liabilities fall due. For investors, the market value of government liabilities matters only in so far as they intend to sell or buy such liabilities on the market. However, in evaluating government solvency, also investors should look at redemption values. Furthermore, reference to market values makes the debt measure extremely volatile[18].

Finally real values or ratios to GDP seem appropriate if the ultimate objective of the analysis is to measure the bearability of the tax cost induced by the debt.

Once the choice concerning the debt measure is made, the deficit must be measured accordingly, so that equation (1) holds. Ex post this poses no special problems: the deficit can simply be computed as the first difference of debt. Ex ante, however, information on the items determining the deficit is needed to produce forecasts.

The most detailed deficit data are those from national accounts. From the point of view of its financing, national accounts deficit represents the difference between transaction in assets and transactions in liabilities: conceptually it corresponds to changes in net debt measures[19]. However, these deficit figures are not fully consistent with nominal net debt dynamics; they need to be corrected to take into account three factors: (a) exchange rate fluctuations affect the whole stock of foreign currency denominated assets and liabilities (they determine a change in net debt) but are not reflected in the deficit as this is only concerned with actual transactions; (b) different accounting conventions are adopted for recording the effect of transactions on stocks and on flows with respect to liabilities not issued at par and to liabilities

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[18] If a net measure of debt is used, symmetry would require that assets be valued in the same way as liabilities. However, an argument for market valuation of assets in any case could be made, based on the consideration that they can only be sold at market prices.

[19] To obtain a measure consistent with gross debt changes, national account deficit data should be corrected for transactions in assets (obtaining a measure of borrowing requirement).

denominated in foreign currency[20]; (c) sales/acquisitions of assets affect the net debt stock according to the nominal (book) value of the assets, while they enter the deficit according to their market value (the price paid).

The methodological choices adopted in studies assessing sustainability are by no means homogeneous. Both net and gross debt measures have been used and sometimes also mixed solutions have been adopted. Both market and face valuation of liabilities have been taken into consideration.

Pension liabilities

In recent years a number of studies have estimated the liabilities of public pay-as-you-go (PAYG) pension schemes[21] and have argued that these liabilities should be taken into account when evaluating the state and the perspectives of public finances[22]. It has been claimed that "the strains that higher dependency ratios will impose on budget policies can be seen by examining the present value of future net liabilities of the pension systems in the major industrial countries[23]." These suggestions are closely related to several theoretical studies that have pointed to the deficiencies of conventional cash-flow deficit measures in the assessment of fiscal impact and of budgetary sustainability. As to the latter, it has been suggested that, "by relying on conventional accounting methods, budgetary authorities may not be

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[20] Concerning the first aspect, the nominal value of liabilities affects the debt while it is the price actually paid by the creditor that corresponds to the deficit. Concerning the second aspect, foreign currency debt is converted in domestic currency values based on end-of period exchange rates, while the value of the transaction corresponding to the deficit is the one computed on the basis of the exchange rate at the time of the transaction.

[21] See Van den Noord and Herd (1993 and 1994), Kuné, Petit and Pinxt (1993), Hagemann and Nicoletti (1989), Hills (1984), Castellino (1985), Beltrametti (1993) and Rostagno (1995).

[22] See Van den Noord and Herd (1993), IMF (1993), Hoffmann (1993) and Castellino (1985).

[23] IMF (1993, p. 56). The IMF refers to the estimates presented in Van den Noord and Herd (1993).

provided with the means to adequately monitor and control the government's overall fiscal position[24]".

In order to overcome these difficulties it has often been prescribed to resort to "economic deficit" or to "government net worth[25]" Both these solutions would require the inclusion of pensions in fiscal accounts when obligations are incurred rather than when the actual expenditure is made[26]. In order to evaluate economic deficit, contributions to PAYG schemes would have to be classified as a financing item, while pensions would be considered as a loan repayment or as an interest payment. Any change in the present value of pension liabilities would immediately influence government net worth.

Estimates of pension liabilities may represent a useful complement to conventional debt and deficit measures[27]. However, the ratio of accrued pension liabilities to GDP is not an indicator of pension schemes' sustainability[28]. A high liabilities to GDP ratio does not necessarily imply an imbalance in PAYG pension schemes. Nor does it imply that an imbalance will occur in the future. Any judgement about the sustainability of pension schemes and the pressure they exert on public budgets requires estimates about the resources available to pay for the accrued pensions, namely about the evolution of employment and per capita income. The sustainability issue should be addressed with other indicators, such as the pension expenditure to GDP ratio and the contribution rate that assures the cash balance of pension schemes.

Moreover, accrued pension rights differ in many ways from conventional public debt and there are practical as well as theoretical reasons for not including accrued pension liabilities in the deficit and

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24 Towe (1991, p. 110).

25 See, respectively, Kotlikoff (1984) and Buiter (1983). For a critique see Mackenzie (1989). For a survey see Towe (1991) and Blejer and Cheasty (1991).

26 The same methodology would be applied to all "contingent liabilities". A contingent liability can be defined as a public sector action that determines a cash expenditure only if and when a certain event takes place.

27 They provide a measure of the cost of terminating PAYG pension schemes when complying fully with present benefits rules.

28 See Franco (1995).

debt statistics used in defining and evaluating current fiscal policy. Pension liabilities are uncertain and depend on the specific assumptions adopted upon a variety of factors. Pension rights are not embodied in formal contracts and are not tradable (the debtor can modify both the timing and the amount of the payment even taking individual characteristics into account).

EMU definitions

The definition of debt and deficit relevant for EMU's fiscal rules took into account the need to ensure comparability of national statistics and allowing a regular surveillance process. Methodological choices were therefore made with pragmatism. The sector of reference is general government, as defined in the European System of Accounts (ESA) under the responsibility of Eurostat. Debt and deficit are respectively defined as the total of gross general government liabilities at nominal (face) value[29] and as the balance of non financial transactions (as defined in the ESA) of general government.

Reference to a common protocol is obviously helpful for international comparison. Using definitions in line with those adopted by Statistical Offices makes immediately available past data and allows to base forecasts on the most detailed databases. The choice of a gross measure for debt also reflects data availability, since data on assets are not always available and their quality is often poor. However, these solutions come at a cost. The definitions adopted for debt and deficit are not mutually consistent with equation (1) as debt is defined in gross terms while the deficit does not take into account financial transactions in assets[30].

Applied work therefore has to take care of the reconciliation of the two measures. For example, sales of shares of public corporations have played a relevant role in the recent reduction of debt to GDP ratios

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[29] The list of financial instruments to be considered in the compilation of debt figures is also defined with reference to the ESA.

[30] Moreover, with the adoption of the 1995 version of the European System of Accounts (ESA95) the deficit figures are based on accrual accounting.

in some European countries (most notably in Italy). The evaluation of the potential further contribution to debt reduction via this channel is essential for a correct evaluation of the sustainability of a country's fiscal policy.

4 Testing for the present value budget constraint

One strand of the literature is concerned with the statistical testing of the sustainability of past budgetary policies. The sustainability definition adopted in these studies is the second condition proposed by Blanchard *et al.* (1990), the one based on the inter-temporal discounted budget constraint.

This constraint is a crucial tool in modelling Ricardian equivalence. These studies aim at verifying whether "…when a government runs a deficit, is it making an implicit promise to creditors that it will run offsetting surpluses in the future…" (Hamilton and Flavin, 1986, p. 808). The answer to this question would shed light on the soundness of the hypothesis of Ricardian equivalence in macroeconomic modelling.

Aschauer (1985) and Seater and Mariano (1985) tested the hypothesis that governments' receipts must equal expenditures in present-value terms jointly with a permanent income hypothesis. Barro (1984) tested the hypothesis that government is subject to the present value budget constraint jointly with the assumption that taxation and deficit policies have historically been optimal. Hamilton and Flavin (1986) were probably first in testing the present value budget constraint *per se.*

They use the absolute value version of eq. (8):

$$\lim_{T\to\infty} (1+\rho)^{-T} D_T = D_0 + \lim_{T\to\infty} \sum_{t=1}^{T} P_t (1+\rho)^{-t} \qquad (11)$$

where D is the public debt and P is the primary balance. Their null hypothesis is therefore the absolute value version of eq. (9):

$$\lim_{T\to\infty} (1+\rho)^{-T} D_T = 0 \qquad (12)$$

and to frame the alternative hypothesis they select a class of unsustainable fiscal policies, in the sense that they do not meet constraint (11), such that the discounted value of debt has a finite positive limit, i.e.

$$\lim_{T\to\infty} D_T (1+\rho)^{-T} = A > 0 \qquad (13)$$

Substituting from (13) into (11) gives

$$D_0 = - \lim_{T\to\infty} \sum_{t=1}^{T} P_t (1+\rho)^{-t} + A \qquad (14)$$

And finally

$$D_t = - E_t \sum_{i=1}^{\infty} P_{t+i} (1+\rho)^{-i} + A (1+\rho)^{t} + \varepsilon_t \qquad (15)$$

where E is the expectation operator and ε a regression disturbance. From (15) the null hypothesis A=0 can be put to test.

Hamilton and Flavin only consider the interest bearing share of the debt and measure it at market values in real terms. Strictly speaking, their debt measure is neither net nor gross as they take into account one category of government assets (gold holdings). The deficit measure is adjusted accordingly (mainly to include capital gains/losses and to get figures in real value terms).

Based on these data, Hamilton and Flavin use a Dickey-Fuller test for unit roots to check for the stationarity of P_t. Having rejected non stationarity, they note that for any stationary process for (ε_t , $E_t [\Sigma(1+\rho)^{-t}P_t]$), when A=0, D_t will be stationary, whereas for A>0, D_t will not be stationary, they apply the Dickey-Fuller test to D_t and reject the hypothesis of non stationarity. They also run other tests based on the direct estimation of equation (15) making different assumptions about the information set underlying the formation of expectations about future surpluses. Also these tests point to consistency between the data and solvency as defined on the basis of a present-value budget constraint.

This exercise has three main drawbacks: (a) the use of a very small sample (annual data for the period 1960-1984) is not suited for the implementation of the asymptotic tests used by the authors; (b) the assumption of a constant interest rate may imply a misspecification of the

equation; (c) the choice of a very specific alternative hypothesis to $\lim_{T\to\infty} (1+\rho)^{-T} D_T = 0$, namely non-stochastic violation of the solvency condition ($\lim_{T\to\infty} (1+\rho)^{-T} D_T = A$), may have a bearing on the results of the tests.

Concerning the first point, it must be noted that Haug (1990) reaches conclusions similar to those of Hamilton and Flavin using quarterly data for the period 1960-1987. As to the other two points, however, Wilcox (1989), using the same data set as Hamilton and Flavin, shows that if the hypothesis of a constant interest rate is relaxed and if stochastic violations to the solvency condition are considered as well, then the hypothesis that the inter-temporal budget constraint holds must be rejected.

Other similar studies show mixed results which seem to depend on the statistical procedures adopted[31] and on the data set used[32]. This variability of results is to be expected since the data samples are usually small[33] and the procedures applied have low power in this case, becoming especially sensitive to the specification of the hypotheses to be tested. It should also be considered that the profile of market value time series differs significantly from the one of nominal value data; this highlights further the relevance of the issue of data definition examined in section 3.

While certainly relevant and appropriate for the issue they explicitly address, from the point of view of policy evaluation, these studies have the obvious limitation that solvency within a sample period says nothing about solvency in the future. The prospective path of the debt ratio may be very different from the one already recorded non only for regime changes, but also because exogenous factors (like demographic trends) may change the implication of current regimes for the public finances.

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[31] See Artis and Marcellino (1998) for a review.

[32] The data definitions adopted by Hamilton and Flavin and by Wilcox are not used in all other studies. In some cases the national accounts figures for debt to GDP ratios have been used (e.g., in Ucktum and Wickens, 1997).

[33] One exception is Ahmed and Rogers (1995) who use a sample period of 200 and 300 years respectively for the US (1792-1992) and the UK (1692-1992).

Moreover, being based on equation (9), an ever rising debt (or debt to GDP ratio) may pass the tests proposed in these studies for the assessment of sustainability. The methodological difficulties encountered by a proper implementation of the tests further reduce the attractiveness of the approach.

5 Long-term projections and synthetic indicators based on national accounts

5.1 Long term projections

Long term fiscal projections were carried out as early as in 1942 when a 30 year estimate of social expenditure in the UK was included in the Beveridge Report. However, it is from the mid-80s, when it became apparent that Western countries were experiencing major changes in their demographic structure, that an increasing number of studies have examined the long-term prospects for public budgets.

These studies usually focus on those public expenditure items which are particularly dependent on population age structure (such as pension, health, education) seeking to assess the likely change of their incidence on GDP. Some studies go further and develop projections for the primary balance and estimates of the adjustments required to ensure budgetary sustainability in the sense of a stable undiscounted debt to GDP ratio. The stability of the ratio is to be achieved either at the level recorded at the beginning of the simulation period, in line with the first definition proposed by Blanchard *et al.* (1990), or at some other level. The latter solution is more in line with Domar's (1994) approach to the issue.

The most basic approach provides estimates of the effects of demographic changes on public expenditure under the assumption that age-related per capita expenditure levels remain constant in real terms or in per capita GDP terms at the initial level over the projection period. In other words, it is assumed that present standards of transfers and services are maintained for all population age-groups and that there is no behavioural response from governments or households to demographic changes and their budgetary effects.

It should be stressed that estimates combining data on per capita expenditures for different age-groups and for different budgetary items with demographic projections are only indicative measures of the likely effects of demographic change on public expenditure, since they do not take all relevant effects of demographic changes into account[34].

Mechanical estimates are based on the implicit assumption that the marginal cost of providing services to a smaller or a larger number of individuals in each age group in the future will be equal to the present average cost of these services[35]. In other words, it is assumed that there are no economies or diseconomies of scale in the production of public services. This assumption is surely implausible over relatively short periods, because of time-lags in the adjustment of inputs to changes in demand for public services.

Mechanical estimates implicitly assume that demographic changes do not modify present age-related per capita expenditure levels, while they can actually affect them through many different channels. Demographic changes can influence the cost of inputs used in services (e.g., a relative shortage of young workers may increase the cost of public services employing them)[36] and the demand for some services (e.g., a reduction in the number of children per household may, in the long run, increase the demand for elderly care)[37]. They can also affect productivity trends, wage rates and saving ratios [38].

Economies/diseconomies of scale and the effects of demographic changes on the level of age-related per capita expenditure are not usually taken into account in expenditure projections. While the failure to consider economies and diseconomies of scale may

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34 This point is made in OECD (1988), pp. 27-28.

35 See also the several criticisms expressed in Pearson *et al.* (1989).

36 This point is stressed in Pearson *et al.* (1989).

37 Elderly people without children are more likely to demand public services (Pearson *et al.*, 1989).

38 The use of current per capita age-profiles to project expenditure levels is particularly problematic for health care. Several studies noted that a sizeable share of health expenditure occurs in the final part of life. This implies that the number of deaths occurring each year also affects expenditure. It also implies that an increase in life expectancy may have limited effects on lifetime health expenditure. See Zweifel *et al.* (1995).

compromise short period estimates, that concerning system-wide effects may affect long period estimates.

Moreover, it should be stressed that demographic change is just one of the several factors affecting public expenditure dynamics. The contribution of mechanical estimates of the effects of demographic changes to the assessment of the prospects for public expenditure is therefore necessarily limited.

Once non-demographic factors are taken into consideration, there is no reason why age-related per capita expenditure levels remain constant in real terms or in per capita GDP terms on the initial level over the projection period. Standards of transfers and services will change over time.

While several economic, political and social factors can obviously affect the dynamics of per capita transfers and services, the studies examining the prospects of age-related expenditure usually focus only on two rather specific factors: the effects of changes introduced in legislation, but not yet embodied in present expenditure profiles, and the continuation of structural expenditure trends. These two factors are considered because they are consistent with a constant policy approach, while there is usually no attempt to predict the effects of changes in behaviours and policies.

The effects of changes introduced in legislation, but not yet embodied in present expenditure profiles, are particularly relevant for pension expenditure projections, since pension eligibility and transfer ratios can change considerably over time due to the maturation of schemes, i.e. the process of adjustment of all pensions to present retirement rules[39]. On the one hand, pension coverage extensions and benefit improvements usually only produce their full effects on the two ratios after many decades. On the other, quite often reforms curtailing pension benefits are implemented gradually and only display their full effects a long time later (OECD, 1988b). Therefore, the assumption that age-related per capita expenditure levels remain constant is not

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[39] The maturation of pension schemes is examined in Franco and Munzi (1996).

equivalent to a constant policy assumption. It implies that all the effects of changes introduced in legislation are reflected in present age-related per capita expenditure levels.

The continuation of structural expenditure trends (i.e., the assumption that some non-demographic factors relevant in the past would continue to affect expenditure dynamics in the future) is especially relevant for health care expenditure projections. In several countries the health sector has for long periods recorded a price deflator substantially higher than the GDP deflator and a tendency towards a continuous increase in per capita consumption[40].

Projections integrating the mechanical effects of demographic changes with estimates of some additional factors influencing pension and health expenditure were produced by the IMF in 1986 for the seven main Western economies (Heller *et al.*, 1986). The growth in the number of pensioners and the dynamics of the average pension were projected taking the maturity of the different systems into consideration. As to health expenditure, the study outlined a scenario in which average medical costs were rising more rapidly than productivity.

The overall impact of ageing populations on government budget was also examined in the studies carried out by OECD in 1995-1996 (see Leibfritz *et al.*, 1995, Roseveare *et al.*, 1996 and OECD, 1996) and by the European Commission in 1997 (see Franco and Munzi, 1997). Growing awareness of population ageing has also led to a substantial increase in the resources devoted to national long-term public expenditure projections. However, projections for all the main public expenditure items are available for only some countries[41].

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[40] OECD (1993) decomposed nominal health care expenditure growth over the period 1980-1990 for the OECD area (11.8 per cent per year) into the effects of general inflation (8 per cent), medical specific inflation (0.7 per cent), and the increase in volume of services (2.9 per cent, of which 2.4 per cent was attributed to the increase in per capita services and only 0.3 per cent was due to the ageing process).

[41] See Ministry of Finance of Denmark (1995), Ministry of Social Affairs and Health of Finland (1994), State General Accounting Office, Ministry of Treasury of Italy (1996a, 1996b, 1996c, 1997), Shoven *et al*. (1991), for the USA and Englert *et al*. (1994), for Belgium.

The reliability of this type of estimates clearly depends on detailed and updated knowledge of the institutional setting of the countries examined. In this respect, the fact that national projections are not always available is regrettable.

Furthermore, since these studies often rely on national accounts budgetary categories and on gross debt measures, they often leave unexplored the grey area between deficit estimates and debt dynamics deriving from changes in the asset side of general government balance sheets.

Finally, given the partial equilibrium nature of the exercise, a larger role assigned to sensitivity analysis would be a welcome development in future exercises.

5.2 Synthetic indicators

Synthetic indicators of the outcomes of long term projections have been proposed to "… summarise their results through a single number which comes as a simple metric, allowing for a simple interpretation of the result .." (Blanchard *et al.*, 1990, p. 32). In general such indicators are based on long term projections and meet the same difficulties as the exercises examined above: their quality ultimately relies on the projections on which they are based.

Buiter (1985) suggests to use the difference between the current primary deficit and the one (p*) that would allow a constant net worth to GDP ratio (w):

$$p^* - p_t = [(\gamma - \rho)/(1+\gamma)]w_t - p_t \qquad (16)$$

Apart from the difficulty of obtaining reliable data on net worth, the main problem with this indicator is that the value it takes at any given time says nothing as to the implication of current policies for its future values. A negative (positive) value signalling a growing (decreasing) net worth ratio now may nevertheless be consistent with a prospective decrease (increase) of the ratio as the effects of current policies on deficits gradually unfold in the future.

A forward looking perspective is taken by the tax-gap indicator proposed by Blanchard *et al.* (1990). This is based on their first condition for sustainability, i.e. that the debt ratio eventually comes back to its initial level over a period to be specified. Using projections of primary expenditure (G) and assuming constant interest and growth rates, a tax rate is computed (τ^*) that, if kept constant, allows this condition to be satisfied:

$$\tau_n^* = (\rho - \gamma)((1 - e^{-(\rho-\gamma)n})\int_0^n G_s e^{(\rho-\gamma)(-s)} ds + d_0) \qquad (17)$$

The difference between such tax rate and the current one (τ_n*-τ) is the proposed sustainability index. A positive value indicates that a correction is needed to prevent the debt ratio from rising over the period considered. Higher values denote the need for larger corrections. The indicator has an intuitive interpretation and one which is in the spirit of Domar's approach (that sustainability is to be judged with respect to the tax rate implied by a given policy)[42].

The main shortcoming of the tax-gap are in the arbitrary nature of the choices required about the time horizon (n) and the target debt to GDP ratio at the end of the period (d_0). Moreover, it should be considered that the simple and intuitive metric adopted by the tax gap does not immediately translate into policy indications. For example, a positive gap signals some budgetary pressures in the future, but says nothing about their timing. Over the period taken into consideration both the deficit and the debt ratios may experience "unsustainable" peaks.

A synthetic indicator along the lines of the tax-gap was also employed by Delbecque and Bogaert (1994) who carried out an analysis for Belgium for the period up to 2050 and calculated the "recommended

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[42] Blanchard *et al.* (1990) estimated a long-term tax-gap for 18 countries over a 40 year horizon taking long-term projections of pension and health care expenditure into account. They also estimated a short and a medium term tax-gap which are not affected by demographic changes: the former is computed on a one-year time horizon and does not require projections; the latter relies on five year projections of economic activity and public spending and considers expected cyclical effects. OECD (1996) estimated short term tax gaps from the year 2000 onwards in order to evaluate the increase in tax rates which, in each year, would offset the increase in public expenditure determined by ageing.

primary surplus", defined as the level of the primary surplus that would guarantee the long-term sustainability of fiscal policy, given the actual pension expenditure projections[43]. The recommended primary surplus allows pension expenditure increases to be fully offset by a decline in interest payments caused by a fast reduction in the debt to GDP ratio.

6 Generational accounts

"…To assess the fiscal burden current generations are placing on future generations…" (Auerbach *et al.*, 1991, p. 55), generational accounting use long term projections of the variables appearing in the present value budget constraint in absolute values[44]

$$-D_t = \Sigma_{s=t+1,\infty} [P_s \Pi_{j=t+1,s} (1+r_j)^{-1}] \quad (18)$$

Being based on long-term projections of budgetary items, generational accounts are subject to the same criticism as the methodologies examined in section 5. In addition some problems specific to generational accounts can be identified.

In generational accounts the variables appearing in (18) are grouped in a different manner with respect to standard national accounts presentation. The primary surplus can be disaggregated into its components and there is no single way to operate. While the standard accounting convention is to simply distinguish between revenues and expenditures, other groupings may be preferred depending on the aim of the analysis. In generational accounts government consumption (C) is separated from the other components of the primary balance (O); the

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[43] In a first stage, they computed the "required minimum primary surplus", defined as the level of the primary surplus that could be maintained forever without giving rise to an explosion of the public debt. This is similar to the computation of Buiter's (1985) indicator. As pointed out in the text, the main drawback of this exercise is that it says nothing as to whether current policies allow the actual primary balance to remain in line with the one required for a stable debt to GDP ratio.

[44] Generational accounting was first applied in the United States by Auerbach *et al.* (1991). In the United States and Norway it has also been introduced in official budget documents. Estimates have since been produced for several European countries (see Raffelhüschen, 1997 for a review).

latter are then grouped according to the generation which pays them or benefits from them:

$$P_s = \Sigma_{i=0,M} O_{s,s-i} - C_s \qquad (19)$$

where the terms $O_{s,s-i}$ represent the net payments to government made at time s by the generation born at time s-i; M is the maximum length of life so that payments made by all generations alive at time s are considered.

By substituting (19) into (18) we get

$$D_t = \Sigma_{s=t+1,\infty} [(\Sigma_{i=0,M} O_{s,s-i} - C_s) \Pi_{j=t+1,s} (1+r_j)^{-1}] =$$

$$= \Sigma_{s=t+1,\infty} [(\Sigma_{i=0,M} O_{s,s-i}) \Pi_{j=t+1,s} (1+r_j)^{-1}] - \Sigma_{s=t+1,\infty} [C_s \Pi_{j=t+1,s} (1+r_j)^{-1}] \qquad (20)$$

and, separating generations born prior to time t from those born thereafter

$$D_t = \Sigma_{i=0,M} [\Sigma_{s=t+1,t-i+M} O_{s,t-i} \Pi_{j=t+1,s} (1+r_j)^{-1}] +$$

$$+ \Sigma_{i=1,\infty} [\Sigma_{s=t+i,t+i+M} O_{s,t+i} \Pi_{j=t+1,s} (1+r_j)^{-1}] - \Sigma_{s=t+1,\infty} [C_s \Pi_{j=t+1,s} (1+r_j)^{-1}] =$$

$$= \Sigma_{i=0,M} N_{t,t-i} + \Sigma_{i=1,\infty} N_{t,t+i} - \Sigma_{s=t+1,\infty} [C_s \Pi_{j=t+1,s} (1+r_j)^{-1}] \qquad (21)$$

where $N_{t,k}$ represents the value at time t of the net payments to government to be made by a generation born at time k.

Equation (21) corresponds to the standard presentation of generational accounting (Auerbach *et al.*, 1991, 1992)[45]. Given present debt (D_t), forecasts for future government consumption (the third term on the right hand side) and future net payments by existing generations based on current policies (the first term on the r.h.s), equation (19) can be solved for the present value of net payments required from future generations (the second term on the r.h.s.). The amount that needs to be paid by each future generation is assumed constant up to an adjustment

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[45] There are a couple of differences: (a) in our formulation gross debt is used rather than net wealth; (b) the terms $O_{i,j}$ are already adjusted for the size of the generations whereas in the standard presentation the adjustment is made explicit.

for real productivity growth. It is then compared with the amount projected to be paid by the generation born at time t (based on current policies) in order to signal a potential generational imbalance in fiscal policy.

The identification of the empirical counterparts of the theoretical variables appearing in equation (21) is a crucial issue. For example, in the standard presentation of generational accounts net wealth is used rather than gross debt and since net wealth is measured by means of capitalised net interests, the problem of the appropriate treatment of non interest bearing assets arises.

The quality of long-term projections is also essential. Current expenditure level for each generation remain stable in the future. This disregards the future effects of legislative changes already introduced, economies of scale in the production of public services, the likely effects of demographic developments on relative prices and work, consumption and investment decisions. Moreover, as pointed out for standard long-term projections, the estimation of public expenditure attributed to each age-group is problematic. Expenditure profiles can be estimated with reference to different age-groups, budgetary items, definitions of public sector. This may substantially limit the comparability of the results obtained for different countries [46].

Another relevant issue concerns the grouping of primary balance components, the choice to classify non-age related expenditure as government consumption thus excluding the benefits (often delayed) they produce from the computation of net payments by each generation is not unquestionable[47]. The problem is made worse by the fact that different rules are used to produce future values of what is classified as government consumption and what is instead labelled as net payments[48].

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[46] For a comparison of the age-related expenditure profiles underlying some studies referring to European countries see Franco and Munzi (1997).

[47] The point is especially relevant for investment expenditures.

[48] This point is made by Robinson (1999) who shows that the "equity norm" implicit in GA is arbitrary since while it requires that net payment be constant across generations as a share of

(continues)

Moreover, generational grouping largely determines the result[49]. Suppose that the economic and demographic conditions are stable and that current policies have led to $D_t>0$. Generational accounts apply the inter-temporal budget constraint from time t+1; thus payments by generations alive from time t+1 on will have to be sufficient not only to repay past debt but also to balance new government consumption: such payments are split so that all those already alive prior to time t+1 will keep on paying according to previous rules (i.e. insufficiently to avoid new debt accumulation), while the others will have to pay the balance. By definition this is more than their fair share.

Summarising, the main problem specific to generational accounting[50]. is the upward bias its methodology induces in the assessment of the effort needed to ensure solvency. Given the existence of debt, the imposition of an inter-temporal budget constraint implies it will have to be repaid. So we know from the start that an effort is needed for solvency. What is of relevance is an assessment of the effort needed. In generational accounts this assessment is problematic: (a) the special treatment of government consumption introduces an upward bias; (b) so do the different rules applying to present and future generations and especially the fact that future effects of legislative changes already introduced are not taken into account; (c) the estimation of present net worth value is not unproblematic.

From a policy point of view, much as in the case of the tax gap, it is also relevant that the synthetic indicators derived from generational accounts do not provide information about the timing of the effects of demographic changes. Moreover, its results are not intuitive, which may hamper their use for policy objectives, and are very sensitive to assumptions about the determination of private consumption, productivity growth and discount rates[51].

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generation's income, concerning government consumption it demands that it be constant in per-capita terms.

49 See, e.g., Haveman (1994) and Robinson (1999).

50 For a critical assessment of generational accounting, see, e.g., Buiter (1995) and Haveman (1994).

51 On this issue see Hagemann and John (1995) and IMF (1996).

7 Conclusions

Our analysis has highlighted three main problems, respectively concerning the definition of sustainability, the choice of relevant variables, the measurement of sustainability.

Definition of sustainability – So far economic literature has not defined a unique benchmark against which to assess sustainability. Moreover, the definitions proposed are based on partial equilibrium analysis and therefore point to necessary but not sufficient conditions for sustainability. For example, in Domar's framework, in order to be sustainable the debt to GDP ratio must be stable, but not any stable level is necessarily sustainable. To assess the maximum sustainable debt level we should take the interaction of public finance and the economy into account.

Definition of variables – The lack of a unique theoretical benchmark contributes to legitimating a multiplicity of statistical criteria for the definition of public debt and deficit. Furthermore, data availability constrains the degree to which the theoretical variables appearing in the models can be correctly measured or proxied in practice. Sometimes mutually inconsistent measures of debt and deficit are used.

Computation of sustainability indicators – All indicators are based on long-term projections of budgetary trends which are necessarily uncertain and whose modelling is, moreover, still very simplistic. Long-term budgetary developments are determined by a multiplicity of interacting factors (e.g., changes in relative prices and family structure). However, existing projections usually take into account only demographic developments and rely on overly restrictive assumptions concerning the other factors (e.g., constant age-related expenditure profiles are projected to the future). Synthetic indicators have the additional disadvantage to provide measures of future imbalances that do not immediately translate into policy prescriptions. Moreover, their computation may require arbitrary assumptions. These critiques particularly apply to generational accounting projections and summary measures. With respect to traditional techniques, however, generational accounting allows estimates of the distributive implications across generations of changes in budgetary policies and considers the effects of policy changes that do not affect the conventional deficit.

In devising fiscal rules for EMU, when confronted with these difficulties, European Union countries adopted a pragmatic approach. The Treaty of Maastricht defines sustainability as non-violation of arbitrarily predetermined parametric standards; it defines the relevant variables taking into account the need to ensure comparability of national statistics and to allow a regular surveillance process. However, the Treaty and the Stability and Growth Pact do not deal with the development of sustainability indicators. They introduce a complex procedure ensuring monitoring of budgetary trends over the medium-term, but do not envisage any long-term control.

As pointed out in Section 2, compliance with these rules and guidelines ensures sustainability. If EU countries stick to the close-to-balance guideline, they will converge to equilibrium low debt levels (significantly below the 60 per cent threshold). Some countries might even converge to negative debt levels. One may question whether a theory-based benchmark, if available, would have implied these results.

However, this framework does not make sustainability indicators unnecessary. Even after the transition to the medium-term targets has been completed, compliance with the rules may require continuous policy action. Due to, inter alia, demographic changes, compliance over the medium term does not necessarily ensure compliance over the long term. There is a need for indicators highlighting prospectives deviations and measuring their size and timing.

The technique of long-term projections is still relatively new. As we pointed out in section 5, the first systematic attempts were produced in the 1980s. Although largely unsatisfactory under various respects, the available indicators have been extensively used by international organisations to highlight prospective budgetary risks and by national authorities to guide the adjustment of expenditure programs to the new demographic conditions. In spite of a methodology which is still rather rough around the edges, the policy indications were broadly correct. They contributed to the significant reduction of prospective budgetary imbalances.

Further efforts are obviously needed to guide more effectively budgetary policy.

(i) In order to improve the quality of projections, it is necessary to invest in better data bases. The statistics underlying several studies are often inadequate both at the micro and the macro level. Age-related expenditure profiles should refer to detailed classifications of expenditure programmes and to micro-simulation studies. The net asset position of general government needs to be more comprehensively assessed.

(ii) In spite of the unavoidable uncertainty of projections, indicators should consider long periods of time. This is necessary in order to avoid the risk of being confronted with the necessity to undertake large and abrupt adjustments which might turn out to be politically unsustainable.

(iii) Indicators should have a transparent interpretation in order to be viable as policy tools. This is also necessary to warrant the effectiveness of multilateral surveillance and peer-pressure in fostering the adoption of needed corrections.

(iv) International institutions have largely contributed to develop long-term budgetary indicators. However, accurate budgetary projections can be produced more easily at the national level, since the wealth of data and institutional knowledge available locally cannot be achieved by international studies. In order to ensure both the cross-country comparability of estimates and their quality, better co-operation is needed between national and international institutions. This is particularly relevant in the context of EMU.

(v) Projections should be carried out on a regular basis. The experience shows that prospective unbalances can vary quite significantly over short periods due to policy changes and other factors. Revisions have a learning-by-doing advantage and may reduce the margins for creative accounting.

(vi) Policy makers should rely on more than one indicator. While standard long-term projections can provide indications about the size and the timing of prospective imbalances, generational accounting is more apt to evaluate the generational distribution of the ensuing burden.

(vii) Finally, indicators should be capable of considering different challenges. In addition to demographic trends, which have already been extensively considered, the risks related to high debt levels

and unfavourable revenue developments should be taken into account.

Clearly, the higher the debt, the stronger the sensitivity of the budget balance to monetary shocks. The usual assumption of a constant interest rate overlooks the risk that a prolonged increase in rates may shift public finances on an unsustainable track. A more systematic use of sensitivity analysis, based on a distribution of interest rate shocks, would be useful.

With the abolition of tariffs and barriers, the increasing internationalisation of markets and of the economies, direct taxation (personal, capital and financial taxation) and indirect taxation (goods and services) among European countries have come under the pressure of increasing competition. Tax bases are eroded as a result of their reallocation to other countries. Tax competition affects public finances also indirectly via its effects on investment, growth and employment. There is a risk that these developments may hamper the significance of available indicators which are based essentially on expenditure projections (revenues are usually assumed constant as a share of GDP). Greater research efforts are needed to integrate the revenue side of the budget in sustainability analyses.

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